

REMARKS/ARGUMENTS

Claims 1-53 are pending in the application. Claims 1-16, 25-31, 35 and 46-53 are amended, and claims 17-22, 24, 32-34 and 36-45 are canceled in the present amendment. New claims 54-65 are added to the present amendment.

Claims 5, 6, 26, 27, 29-34, 36-45 are objected to under 37 C.F.R. § 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claims 5, 6, 26 and 27 are rewritten in independent form. Claims 29-31 are amended to recite the monitoring means including an analyzer for monitoring and/or measuring a parameter in the aqueous solution. This monitoring means requires the addition of an analyzer or other device to the structure of independent claim 14 for monitoring and/or measuring a parameter. Therefore, since claims 29-31 further limit the structure of independent claim 14, they are in proper dependent form. Claims 32-34 and 36-45 are canceled. Claims 5, 6, 26, 27 and 29-31 are now believed to be in proper form for allowance.

Claims 5 and 6 are rejected under 35 U.S.C. § 112 for improper antecedent basis of the element "said ionic current." Claims 1, 5 and 6 are amended to correct the antecedent basis of "said ionic current."

Claim 24 is rejected for the use of a trademark. Claim 24 is canceled.

Claims 1-53 are rejected under the judicially created doctrine of obvious-type double patenting as being unpatentable over claims 1-35 of U.S. Patent No. 6,780,306 in view of U.S. Patent No. 6,203,710 to Woodbridge. Applicant respectfully traverses this rejection. The

amended claims of the present invention are not obvious in view of U.S. Patent No. 6,780,306 and Woodbridge.

Independent claims 1, 5, 6, 13, 14, 26, 27, 46, 47, 48, 49, 50, 51, 52 and 53 are amended to include a high frequency AC power source coupled to a flow cell or a treatment cell. The power source includes a signal generator coupled to a power amplifier which is coupled to an impedance matching transformer. The power source creates an electromagnetic field within the flow cell or treatment cell, and creates an ionic current flow, generating hydrogen peroxide and hydroxyl radicals in the aqueous solution for disinfection and/or oxidation of the aqueous solution. U.S. Patent No. 6,780,306 does not teach or suggest the use of a high frequency AC power source including a signal generator coupled to a power amplifier which is coupled to an impedance matching transformer. The Woodbridge reference also does not teach or suggest the use of a high frequency AC power source generating an electromagnetic field or creating an ionic current flow within the flow cell or treatment cell.

Claims 2-4 and 7-12 are dependent claims dependent upon independent claim 1, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 15, 16, 23, 25, 28-31 and 35 are dependent claims dependent upon independent claim 14, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 17-22, 24, 32-34 and 36-45 are canceled.

The inductively-coupled embodiment of the electroionic processing apparatus and method presented in the present invention represents a major aspect of the technology. This technology is implemented through a tuned LCR circuit. This inductively-coupled embodiment

has certain advantages of efficiency particularly in large installations. It is in no way related to the capacitively-coupled embodiment of the technology which is described separately. Nothing resembling the inductively-coupled embodiment of the present invention was contained in any of the cited prior art references. The inductively-coupled embodiment represents an extremely innovative development in that it required in its implementation a specially wound coil to minimize the stray capacitance. Without minimization of stray capacitance, the tuned LCR circuit would not function. In addition, the capacitor in the LCR circuit had to be custom made since no capacitor of sufficient stability was available commercially.

The high frequency AC electromagnetic field-based hydrogen peroxide generating process described in the present invention is quite different from the process described in U.S. Patent No. 6,780,306, which describes a DC-based process.

In DC-based electrolysis, hydrogen peroxide formation occurs near the electrode surfaces (primarily the cathode), but the volumes of hydrogen peroxide generated are too small to be commercially useful. In higher frequency AC-based electrolysis, however, electroionic reactions including production of hydrogen peroxide occur throughout the treatment cell resulting in a much greater volume that is very competitive. In fact, the cost of production is less than 1 cent per pound while the commercial price for hydrogen peroxide is over 60 cents per pound. It is easy to verify the cell-wide production in the treatment cell by observing the bubbles from the hydrogen and oxygen gas generation surfacing throughout the cell, and not just at electrode surfaces. High frequency AC electrolysis represents a whole new field of electrochemical engineering and is certainly not the basis for double patenting. This new field of knowledge has

certainly not been obvious to multiple generations of electrochemical engineers over the last 125 years.

The Woodbridge reference does not disclose a process for the generation of hydrogen peroxide as a vehicle for the disinfection of microorganisms and the oxidation of organic/inorganic pollutants in water/wastewater in any way similar to the present invention. The process described in the Woodbridge reference does not generate hydrogen peroxide in the manner described in the present invention but in fact utilizes an external predetermined gas, such as nitrogen, ozone, oxygen or hydrogen peroxide to decontaminate the incoming liquid. The electroionic process described in the present invention takes place without any external liquid or gas inputs.

In the Woodbridge patent, the only reference hydrogen peroxide generation occurs in column 2, lines 1-9 where it refers to organic radicals and the breakdown of peroxy radicals through a complicated bio-molecular decay to yield hydrogen peroxide and other by-products. This chance occasional reaction is clearly not the simple and straightforward hydrogen peroxide generation process described in the present invention. The Woodbridge patent admits its uncertain and occasional nature by continually calling for addition of external hydrogen peroxide throughout the patent.

Further, the process described in the Woodbridge reference is based primarily on the employment of a static DC electric field and a static permanent magnet-based magnetic field applied separately, not as an electromagnetically generated AC field as in the present invention. The AC power generator and matching transformer required to generate and create such an

electromagnetic field are not described in the Woodbridge reference. In fact, Woodbridge emphasizes the independent nature of the electric and magnetic fields (column 1, lines 42-51). Such independence is not possible in an AC-based electromagnetic field. Having a DC generated electric field and a magnet generated magnetic field does not produce an AC electromagnetic field that follows Faraday's laws and is consistent with Maxwell's equations.

The Woodbridge patent is based primarily on the generation of hydroxyl and other radicals for disinfection and removal of contaminants. Hydroxyl radicals are generated only in limited pH ranges and in the presence of the ferrous iron (Fe^{2+}). Such hydroxyl radicals are, therefore, not a reliable and dependable agent for disinfection action but only an add-on "bonus" factor when specified wastewater/water conditions of pH and iron content are present. Hydrogen peroxide, in contrast, using the electroionic process of the present invention, is generated over the full operational pH range and is, therefore, a reliable and dependable agent of wastewater and/or potable water disinfection.

There are significant differences between the claims of the present invention and the claims of U.S. Patent No. 6,780,306 in view of Woodbridge. Therefore, the rejection under the judicially created doctrine of obviousness-type double patenting should be withdrawn.

Claims 1, 4-7, 13, 14, 23, 26, 27, 35-45 and 49-53 are rejected under 35 U.S.C. § 102(b) as being anticipated by Woodbridge. Applicant respectfully traverses this rejection. As discussed above, the Woodbridge reference does not teach or suggest an electroionic apparatus and method as recited in claims 1, 4-7, 13, 14, 23, 26, 27, 35, 51 and 49-53. Claims 36-45 are

canceled. Therefore, Applicant believes that claims 1, 4-7, 13, 14, 23, 26, 27, 35, 51 and 49-53 contain patentable subject matter and are in condition for allowance.

Claims 2, 3, 15-25 and 46-48 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Woodbridge as applied to the claims above, and further in view of U.S. patent application publication No. 2002/0056634 to Pitts, Jr. et al. Applicant respectfully traverses this rejection. Claims 2 and 3 are dependent claims dependent upon independent claim 1, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 15, 16, 23 and 25 are dependent claims dependent upon independent claim 14, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 17-22 and 24 are canceled.

The capacitive coupling process of the Pitts patent in no way resembles the capacitive coupling described in the present invention. The Pitts' capacitive coupling apparatus and method creates an electrostatic field using 30,000 volts DC to prevent biofilm formation. The capacitive coupling apparatus and method claims in the present invention recite a high frequency AC generated electromagnetic field having a thin film coating of dielectric material coated on at least one side of each electrode to prevent fouling on the inner surface of each electrode.

Claims 8-12 and 28-34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Woodbridge as applied to the claims above, and further in view of an article entitled, "Disinfection of Wastewater by Hydrogen Peroxide or Peracetic Acid: Development Procedures for Measurement of Residual Disinfection and Application to a Physicochemically Treated Municipal Effluent." to Wagner et al. Applicant respectfully traverses this rejection. Claims 8-

12 are dependent claims dependent upon independent claim 1, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 28-31 are dependent claims dependent upon independent claim 14, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 32-34 are canceled.

The Wagner reference does not teach or suggest an on-line method of monitoring hydrogen peroxide or other parameters for process control. It only recites a series of off-line labor intensive laboratory procedures, none of which is able to provide timely information for process control. Process control requires an automated, fast response method, not time-consuming laboratory procedures.

The Wagner article also does not disclose hydrogen peroxide as a routine method of wastewater treatment. It was based on a research project that rejected H₂O₂ as a standard method because of its cost. This cost disadvantage is removed by the technology described in the present invention.

New claims 54-65 are added to further define the invention and recite elements not in the original set of claims. None of the cited references teach or suggest the required claim elements of new claims 54-65. Claims 54 and 55 are dependent claims dependent upon independent claim 1, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claims 56-63 are dependent claims dependent upon independent claim 13, and thus should be allowable for the above reasons as well as for the additional elements they contain. Claim 64 is a dependent claim dependent upon independent claim 46, and thus should be allowable for the above reasons as well as for the additional elements it contains. Applicant

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believes that new claims 54-65 contain patentable subject matter and are in condition for allowance.

In view of the amendments and remarks presented above, the Applicant believes that the application is now in condition for allowance, and respectfully requests reconsideration of the application, withdrawal of the rejections and allowance of the claims. No new matter has been added to the application.

Respectfully submitted,

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